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HARD CHOICES

A Report on the Increasing Gap Between America's Infrastructure Needs and Our Ability To Pay for Them

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Appendix 21. TENNESSEE

A CASE STUDY

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON ECONOMIC GOALS AND INTERGOVERNMENTAL POLICY

OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

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Preface

Infrastructure problems are widespread. They do not respect regional or state boundaries. To secure a better data base concerning national and state infrastructure conditions and to develop threshold estimates of national and state infrastructure conditions, the Joint Economic Committee of the Congress requested that the University of Colorado's Graduate School of Public Affairs direct a twenty-three state infrastructure study. Simultaneously, the JEC appointed a National Infrastructure Advisory Committee to monitor study progress, review study findings and help develop policy recommendations to the Congress.

In almost all cases, the studies were prepared by principal analysts from a university or college within the state, following a design developed by the University of Colorado. Close collaboration was required and was received from the Governor's staff and relevant state agencies.

Because of fiscal constraints each participating university or college agreed to forego normal overhead and each researcher agreed to contribute considerable time to the analysis. Both are to be commended for their commitment to a unique and important national effort for the Congress of the United States.

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INFRASTRUCTURE NEEDS AND RESOURCES OF SELECTED STATE AND LOCAL GOVERNMENT PROGRAMS IN TENNESSEE

REVISED DRAFT

Center for High Technology Management
and Economic Research
School of Administrative Science
The University of Alabama in Huntsville

OCTOBER, 1983

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CHAPTER I: INTRODUCTION AND SUMMARY

Tennessee, like most other states, has been grappling with the problem of deteriorating public infrastructure for many years. While the demand for more and better public services remains unabated, the resources to meet those demands has been shrinking because of the slower growth of the State's economy and consequently its tax base, and declining federal intergovernmental assistance for highways, mass transit, and sewage treatment facilities. This report presents a discussion of future infrastructure needs in Tennessee for sewerage facilities, highways, water supply, airports, and mass transit.

This report is a product of Tennessee's participation in a national study of infrastructure needs sponsored by the Joint Economic Committee of the Congress and coordinated by the Graduate School of Public Affairs at the University of Colorado in Denver. On invitation of Congressman Henry Reuss, then Chairman of the Joint Economic Committee, Governor Alexander agreed to Tennessee's participation and designated the Center for High Technology Management and Economic Research (CHTMER) at the University of Alabama in Huntsville to conduct the study. The Office of the Chief Economist, Tennessee Valley Authority, agreed to pay all costs associated with the project. Tennessee is one of about 25 states participating in the Joint Economic Committee Study.

Scope of the Study

Because of the extremely short time frame and the limited resources available for its completion, the study was limited to a survey of existing data on Tennessee State and local government infrastructure needs, projected to the year 2000. Infrastructure was defined to include highways, roads and streets; mass transit; airports; sewerage systems; and public water supply. The study does not include federal government infrastructure such as dams and locks, electric power plants, recreation areas, forest roads and other federal facilities, although they are vital to Tennessee's future. Because of time and funding constraints, it also excludes State and local government facilities for solid waste, recreation, education, and correction. Infrastructure primarily owned and operated by the private sector such as gas pipelines, railroads, telecommunications, and trucking terminals are also excluded from the analysis.

The Present and Future Tennessee Economy

The Tennessee economy was hard hit by the double recessions of 1980 and 1981-1982. As shown in Table I-1, Tennessee's Gross State

Table 1-1

Historical Growth of The Tennessee Economy: 1972-1982

Variable	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TN Gross State Product*	20,976.0	23,983.0	26,011.0	27,139.0	30,609.0	34,885.0	39,629.0	43,629.0	46,028.0	51,149.0	53,193.0
Percentage of Change	13.38	13.91	8.86	4.34	12.79	13.97	13.60	10.09	5.50	11.12	4.00
TN Gross State Product**	20,976.1	22,878.6	23,011.8	21,838.0	23,460.3	25,160.4	26,735.0	27,544.5	26,731.3	27,270.9	26,433.1
Percentage of Change	9.83	9.07	0.58	-5.10	7.43	7.25	6.26	3.03	-2.95	2.02	-3.07
US Gross National Product ***	1,185.9	1,255.0	1,248.0	1,233.9	1,298.2	1,369.7	1,438.6	1,479.4	1,474.0	1,502.6	1,480.0
Percentage of Change	5.66	5.83	-0.56	-1.13	5.21	5.51	5.03	2.84	-0.37	1.94	-1.50
TN Personal Income*	14,981.0	17,011.0	18,793.0	20,304.0	22,672.0	25,155.0	28,542.0	31,983.0	35,031.0	38,957.0	41,280.0
Percentage of Change	12.15	13.55	10.47	8.04	11.66	10.95	13.46	12.06	9.53	11.21	5.96
TN Personal Income **	14,980.6	16,093.8	16,158.9	16,216.9	17,210.9	18,052.4	19,145.9	19,684.5	19,551.4	20,029.4	20,107.3
Percentage of Change	8.22	7.43	0.40	0.36	6.13	4.89	6.06	2.81	-0.68	2.44	0.39
US Personal Income***	951.4	1,007.7	1,004.8	1,010.4	1,056.1	1,105.5	1,162.3	1,200.9	1,205.8	1,242.1	1,251.3
Percentage of Change	5.71	5.93	-0.29	0.55	4.53	4.67	5.14	3.32	0.41	3.01	0.75
TN Per Capita Income (Dollars)	3,664.0	4,111.0	4,473.0	4,765.0	5,237.0	5,715.0	6,397.0	7,055.0	7,613.0	8,447.0	8,910.0
Percentage of Change	10.00	12.20	8.81	6.53	9.91	9.13	11.93	10.29	7.91	10.95	5.48
TN Population (Thousands)	4,088.0	4,138.0	4,202.0	4,261.0	4,329.0	4,402.0	4,462.0	4,533.0	4,602.0	4,612.0	4,633.0
Percentage of Change	1.95	1.22	1.55	1.40	1.60	1.69	1.36	1.59	1.52	0.22	0.46

* Millions of dollars. ** Millions of 1972 dollars. *** Billions of 1972 dollars.

Source: Tennessee Econometric Model, Center for Business and Economic Research, University of Tennessee in Knoxville, Tennessee.

Product (GSP) declined 1.95 percent in real terms in 1980 and 3.07 percent in 1982. This rate of decline in GSP was much greater than in the U.S. Gross National Product during the last two recessions. Since 1979, Tennessee personal income also has grown more slowly than in the nation and population growth has slowed considerably from the pace of the early 1970's.

The national recession hit Tennessee particularly hard for a variety of reasons. First, Tennessee's industrial base is heavily weighted toward industries supplying the national construction sector. Stone, clay, and glass, fabricated metals and the furniture industries all began to reduce their work forces in 1979, one year before the "official" start of the 1980 downturn. Second, Tennessee's labor force has been growing rapidly and the State has experienced net in-migration during most of the 1970's. This rapid labor force expansion has probably added to the State's unemployment problem for the past three years. Third, the growth of the government sector has slowed dramatically with the wind down of TVA's nuclear plant construction program in the State and the tight budget situation of State and local governments.

During most of the 70's, Tennessee's unemployment rate remained below the national average; but, as shown in Table I-2, since 1979 it has been higher. During the depths of the last recession, the State's unemployment rate was among the highest in the nation and on an annual average basis was nearly two percentage points above the U.S. rate. The State's economy is expected to recover from the recession somewhat more slowly than average with gross state product forecast to increase just 2.78 percent this year and 4.08 percent next. This forecast rate of recovery, shown in Table I-3, probably will not occur fast enough to reduce the unemployment rate appreciably this year and the rate is forecast to continue to exceed the U.S. average for the next five years.

The growth of State and local revenues also has slowed down substantially since 1980. Between fiscal 1972 and 1976, State own-source revenues grew at a compounded annual rate of 10.2 percent and federal transfers to State government at a 14.6 percent rate. Local revenues grew even faster during this period with federal transfers increasing at a 26.1 percent annual rate. The annual rate of growth in State revenue increased to 13 percent during the fiscal 1976-80 period but fell abruptly to just 5.4 percent in fiscal years 1980 to 1982 (see Table I-4). Similarly, the annual growth of local revenues declined from 11.0 percent to 9.1 percent. This slowdown was primarily caused by the drastic drop in the year-to-year growth of federal intergovernmental assistance. In the case of the State, federal aid grew 1.6 percent a year during 1980-1982 -- one-tenth the annual rate of the previous four-year period. As can be seen in Table I-4, federal aid to local governments declined in absolute terms after fiscal 1980. At the same time there was an abrupt slowdown in the growth of State assistance to local governments. Between 1976 and 1980, this grew at a 10.2 percent annual rate, and after 1980, at a rate of only 3 percent. This fall-off in the expansion of intergovernmental aid has put more pressure on local own-source revenues. Local governments increased revenue collections from local sources at a 13.8 percent annual rate after

Table I-2

Historical and Forecast Relation Between the Tennessee and U.S. Unemployment Rates: 1972 to 1983 and Forecast to 1991

Year	Unemployment Rate		Tennessee Rate Minus U.S. Rate
	Tennessee	U.S.	
HISTORICAL ANNUAL AVERAGE			
1972	3.7	5.6	-1.9
1973	3.9	4.9	-1.0
1974	5.1	5.6	-0.5
1975	8.3	8.5	-0.2
1976	6.0	7.7	-1.7
1977	6.3	7.1	-0.8
1978	5.7	6.1	-0.4
1979	5.8	5.8	0.0
1980	7.3	7.1	+0.2
1981	9.1	7.6	+1.5
1982	11.5	9.6	+1.9
FORECAST ANNUAL AVERAGE			
1983	11.4	9.7	+1.7
1984	10.6	8.9	+1.7
1985	9.8	8.1	+1.7
1986	9.4	8.3	+1.1
1987	8.4	7.8	+0.6
1988	7.4	7.3	+0.1
1989	6.7	7.0	-0.3
1990	6.3	6.8	-0.5
1991	5.8	6.3	-0.5

Source: Tennessee Enconometric Model, Center for Business and Economic Research, University of Tennessee, Knoxville.

Table I-3

Forecast of the Growth of the Tennessee Economy: 1983-1991

Variable	1983	1984	1985	1986	1987	1988	1989	1990	1991
TN Gross State Product*	57,574.0	63,561.0	69,797.0	76,117.0	83,216.0	90,096.0	97,168.0	104,315.0	112,867.0
Percentage of Change	8.23	10.40	9.81	9.05	9.33	8.27	7.85	7.36	8.20
TN Gross State Product**	27,168.7	28,277.5	29,157.4	29,853.6	30,927.0	31,990.1	33,034.6	33,924.7	35,149.1
Percentage of Change	2.78	4.08	3.11	2.39	3.60	3.44	3.27	2.69	3.61
US Gross National Product***	1,527.7	1,604.3	1,663.4	1,695.5	1,756.6	1,814.5	1,862.9	1,899.0	1,966.7
Percentage of Change	3.22	5.01	3.68	1.93	3.60	3.30	2.67	1.94	3.57
TN Personal Income*	44,591.0	48,435.0	53,016.0	57,767.0	62,910.0	68,024.0	73,279.0	78,657.0	84,817.0
Percentage of Change	8.02	8.62	9.46	8.96	8.90	8.13	7.73	7.34	7.83
TN Personal Income**	20,529.8	20,958.5	21,446.7	21,948.1	22,670.4	23,448.3	24,152.6	24,852.0	25,508.8
Percentage of Change	2.10	2.09	2.33	2.34	3.29	3.43	3.00	2.90	2.64
US Personal Income***	1,283.1	1,322.4	1,360.4	1,392.1	1,446.1	1,494.0	1,529.3	1,559.6	1,598.5
Percentage of Change	2.54	3.06	2.88	2.33	3.88	3.31	2.37	1.98	2.50
TN Per Capita Income ($)	9,558.0	10,318.0	11,217.0	12,077.0	13,016.0	13,915.0	14,790.0	15,671.0	16,694.0
Percentage of Change	7.28	7.95	8.72	7.66	7.77	6.91	6.29	5.95	6.53
TN Population (Thousands)	4,665.0	4,694.0	4,726.0	4,783.0	4,833.0	4,889.0	4,955.0	5,019.0	5,081.0
Percentage of Change	0.69	0.63	0.68	1.21	1.05	1.14	1.35	1.31	1.22

* Millions of dollars. ** Millions of 1972 dollars. *** Billions of 1972 dollars.

Source: Tennessee Econometric Model, Center for Business and Economic Research, University of Tennessee in Knoxville, Tennessee.

Table I-4

Historical Growth of Tennessee State and Local Government Revenues
FY 1972-1982
(in millions of current dollars)

Fiscal Year	State Revenues			Local Revenues			
	Total	Own Source	Federal Aid	Total	Own Source	State Aid	Federal Aid
1972	$1,364.0	$ 979.7	$ 384.3	$1,379.0	$ 830.0	$ 451.8	$ 97.2
1976	$2,105.0	$1,442.3	$ 662.7	$2,177.9	$1,283.2	$ 648.8	$ 245.9
Annual Compounded Percent Change 1972-1976	11.5%	10.2%	14.6%	12.1%	11.5%	9.5%	26.1%
1980	$3,426.2	$2,215.6	$1,210.6	$3,308.7	$1,971.4	$ 958.2	$ 379.1
Annual Compounded Percent Change 1976-1980	13.0%	11.3%	16.3%	11.0%	11.3%	10.2%	11.4%
1982	$3,808.2	$2,559.6	$1,248.6	$3,934.7	$2,551.4	$1,016.4	$ 366.9
Annual Compunded Percent Change 1980-1982	5.4%	7.5%	1.6%	9.1%	13.8%	3.0%	-1.6%

Source: Tennessee Econometric Model, Historical Data and December 1982 solution, Center for Business and Economic Research, University of Tennessee, Knoxville.

1980 -- somewhat more than the 11.3 percent annual rate of the previous four-year period. Most of this increase came from higher property tax rates enacted during fiscal 1979 and 1980.[1]

There has been a concomitant slowdown in capital spending for infrastructure at the State level as well. Between fiscal year 1973 and the height of the 1974-75 downturn, the State capital budget grew from $77.3 million to $139.8 million. Much of this increase in State expenditures came in the highway program and was for the accelerated completion of the interstate system. This expansion acted to support direct and indirect construction employment at a time when private construction expenditures were falling. The State ran, either by accident or design, a countercyclical budgetary policy during the 1974-75 recession, and this undoubtedly helped keep the unemployment rate lower, especially in the construction sector.

By contrast, during the 1980 recession, the capital budget fell from $113.6 million to $88.8 million.[2] As the recession began in July, 1981, the State capital budget was 37 percent below the 1978-79 figure. State budget policy was quite restrictive and contributed to unemployment pressures in the last two recessions.

In the present economic climate, State and local tax and fee increases to support the maintenance and upgrading of the State's infrastructure will be difficult to enact. Recent cutbacks in federal aid for sewerage treatment and mass transit facilities probably cannot be made up from local sources without putting a severe burden on some jurisdictions in Tennessee.

Infrastructure Needs vs. Revenues

Collecting data on infrastructure needs presented the researchers with two sets of problems. First, 20-year cost projections are unavailable for many critical need categories. Little or no information is available on the cost of correcting the severe soil erosion problem in West Tennessee or mitigating other water quality management problems such as urban storm water runoff, and acid drainage from abandoned strip mines. Similarly, no data are available on the cost of maintenance and expansion of water systems or for new airports or new highway mileage in the State. In other areas, such as mass transit, data were available only for the next five years and the authors had to extrapolate from these figures to get a 20-year needs estimate.

In no case were revenue forecasts available to match the needs estimates. The authors had to develop these based to some extent on the historical growth of local expenditures for the various types of infrastructure and by making some assumptions about the likelihood of future increases in user taxes. Hence, the estimates of need listed in Table I-5 are to a greater or lesser extent "educated guesses". The measure of revenue shortfalls or unmet needs are likewise frought with uncertainty, but the estimates provided are likely to be on the conservative side given the

Table I-5

A Summary of Unmet Infrastructure Needs
in Tennessee: 1983-2000
(in millions of 1982 dollars)

Infrastructures	Estimated Needs	Estimated Revenues	Estimated Unmet Need or Revenue Shortfall
Existing Airports	$ 379.2	$ 305.6	$ -73.6
Mass Transit			
High	$ 1,351.5	$ 883.5	$ -468.0
Low	1,107.4	883.5	-223.9
Sewerage	$ 1,973.1	$ 1,064.7	$ -908.4
Existing Highways	$24,933.8		
High		$20,258.7	$-4,675.1
Low		15,583.6	$-9,350.2
Water Supply	$ 1,209.9	[Not Estimated]	
Soil Erosion		[Not Estimated]	
Storm Water Runoff		[Not Estimated]	
New Airports		[Not Estimated]	
New Highway Mileage		[Not Estimated]	

Source: Center for High Technology Management and Economic Research at the School of Administrative Science, University of Alabama in Huntsville, Alabama.

present taxing and spending policies of Tennessee State and local government and the recent decline in federal support for certain functions.

The combined infrastructure needs measured in this report come to more than $29.8 billion in 1982 dollars. As discussed earlier, this figure excludes a number of "big ticket" items for which data were not available. Adding these to the list would probably bring the total to more than $35 billion. Estimated unmet needs (revenue shortfalls) total $5,881.0 to $9,891.8 million. These figures would undoubtedly be far higher if one added in what has, of necessity, been left out of the analysis.

From the functions included in the study, it appears that the most important measured unmet need is to upgrade the existing State and local highway system to meet minimum safety standards and higher traffic volumes. The second most important measured need is for sewage treatment plant construction and the expansion of sanitary sewer systems in the State's urban areas to attain federally mandated pollution control standards. The third most important need appears to be for operating subsidies to maintain public transit services in Tennessee's major cities.

Tennessee's Response to the Infrastructure Problem

Further deterioration of Tennessee's infrastructure can have a direct effect on the future economic well-being of the State. Presently 25 communities are under some type of sewer hookup moratorium and 40 to 50 more have inadequate water supply systems. These problems preclude the future expansion of these communities until they are corrected. Many streets and highways across the State are currently operating at traffic volumes far above what they were designed for and consequently are congested and unsafe. Their poor condition leads to higher transportation costs and the increased probability of serious accidents. Finally, farmers and urban landowners sustain substantial losses each year from uncontrolled soil erosion on cropland and unchanneled storm water runoff in urban areas.

Tennessee State and local governments are aware of the growing infrastructure problem and have been developing ideas and programs to reduce the enormous costs associated with the maintenance and upgrading of the State's infrastructure over the next 20 years. Governor Alexander has put together a "Safe Growth Team" to investigate alternative ways of financing and building sewerage treatment facilities and water supply systems. Some of the ideas the Team is looking at are a new State grant and loan program, especially for Tennessee's smaller cities and towns; less expensive treatment alternatives for sewerage; re-evaluation of the enforcement of water quality standards on municipal treatment facilities; the use of private enterprise to build and manage treatment facilities ("privatization"); and improvements in the rate structure of municipal water and sewer systems (i.e., marginal cost pricing).[3]

The Tennessee Department of Transportation (TDOT) has recently instituted a new program of cost-sharing with local governments to maintain

and improve local streets and roads and has taken over responsibility for nearly 3,000 miles of secondary roads heretofore maintained by county governments. This realignment of maintenance and jurisdictional responsibility adds approximately 25 percent more miles to the State highway system and makes TDOT responsible for 16 percent of total statewide mileage, and all of the most heavily traveled routes in the State.

The 11 to 12 thousand miles of secondary roads remaining under local jurisdiction have become part of a new local state-aid system and are eligible for funding under a new State program that provides 75 percent State funds for improvements and requires local government to come up with a 25 percent "in-kind" match. This new program leaves Tennessee local governments only responsible for the least traveled roads and streets in the State highway system.[4] TDOT is also using private firms to do routine maintenance on some of the State's main thoroughfares thereby freeing up State crews to concentrate on other parts of the system.

Because of the magnitude of infrastructure needs, it is unlikely that the cost-saving steps the State is now investigating will preclude the necessity for substantial increases in gasoline taxes and other user fees in the future. If the needs identified in this report are to be met in the next 18 years, the burden on users and the Tennessee taxpayer will undoubtedly increase significantly.

Infrastructure Data Problems

As discussed earlier in this Chapter, cost data for many important elements of the State's infrastructure do not currently exist or exist only in fragmented form. Many of the larger cities and State government have sophisticated capital budgeting systems that project out needs for several years in nearly all infrastructure categories. But among small towns and in rural areas no such capital budgeting program currently exists. Recognizing this problem in 1976, the Tennessee State Planning Office worked with the State's nine economic development districts to devise regional, multi-county capital budgets that would incorporate the needs of the State's rural counties. Funds to prepare these regional capital budgets came from a variety of sources including the Department of Housing and Urban Development (701 planning grants), Economic Development Administration, Appalachian Regional Commission, Environmental Protective Agency (208 basin planning), and the U.S. Department of Transportation. However, most of these regional planning grant programs have been severely curtailed or entirely eliminated.

To accurately set priorities and measure infrastructure needs, data must be routinely collected from all areas of the State. Combining data for a number of small communities into regional capital budgets is a cost-effective way of accomplishing this task. These regional capital budgets can then be combined into a State Capital Budget that incorporates both State and local infrastructure needs. The present lack of federal funding for regional planning activities has seriously hampered development of this program in Tennessee. Without regional capital budgeting or similar

programs to survey rural area needs, the identification of the most serious infrastructure problems and development of long run solutions is extremely difficult, if not impossible. It is felt by the authors that a modest federal planning grant program to assist State and multi-county regional planning agencies to routinely prepare regional capital budgets could significantly improve State and federal decision-making on infrastructure needs, especially in rural areas.

CHAPTER II. SEWERAGE SYSTEMS AND THE MAINTENANCE OF WATER QUALITY

Background

Water is one of Tennessee's most important and abundant natural resources. It serves the needs of the State's four million inhabitants for drinking water, industrial uses, recreation, power generation, and agriculture. The quality of the waters of the Tennessee and Cumberland Rivers, their tributaries, and their man-made reservoirs and navigational systems are of crucial importance to the present and future economic growth and quality of life in the State.

According to a recent report by the Tennessee Valley Authority (TVA), "The Tennessee River ranks a relatively clean tenth in overall water quality among the 25 largest rivers in the United States."[5] However, the report goes on to state that some tributaries continue to suffer from critical pollution problems and the mainstream river remains among the lowest in dissolved oxygen content.

There are a number of causes of pollution in the Tennessee and Cumberland River Basins. Non-point source pollution comes from runoff from agricultural and urban lands. Soil erosion from cropland is also a major problem, particularly in the western part of the State where substantial degradation of water quality is produced from the resulting sedimentation. Point sources of pollution include untreated or partially treated water from municipal or privately owned sewer systems; highly toxic pollutants from untreated industrial wastes; thermal pollution from power plants; and acid drainage from unreclaimed strip mines. To assess the surfacewater quality problems in the State, the TVA classifies each occurrence of pollution as "critical", "serious", or "localized". Of the six most critical areas found by TVA, two were primarily caused by municipal wastewater treatment discharge; of four areas classified as serious, one was due to municipal sewerage effluent; and in 22 of the State's 26 localized problem areas, a primary contributing cause was domestic sewerage effluent.

At the present time, 25 cities or utility districts in the State are under some form of sewer hookup moratorium. These cities are listed in Appendix A along with the type of moratorium now in effect. Sewer moratoria severely affect the growth potential of these cities, many of which now suffer from high levels of unemployment due to the recession.

The pollution of groundwater is also a serious problem in Tennessee because one-half of the State's residents get their drinking water from groundwater supplies. Septic tanks are heavily used in the State with

15 to 20,000 permits applied for annually. Although the overall failure rate is unknown, faulty septic tanks undoubtedly contribute significantly to the State's ground and surface water pollution problem.

From this brief discussion, it is clear that wastewater contamination and sewage treatment effluent is an important cause of pollution, although not the only factor degrading water quality in Tennessee. In some areas it is the most critical factor and is the most frequently mentioned cause of water pollution in the TVA survey.

Sewerage Treatment Facility Construction

The Federal Water Pollution Control Act, which contained the first municipal construction grant program, was passed in 1956. The original appropriation was for $50 million a year, with a maximum of $250,000 to be spent on any one project. These small sums of money clearly gave small cities an incentive to participate, but did little to encourage large cities with multi-million dollar projects. By 1966 the program grew to $120 million a year and in 1967 the cap was raised to $600,000 per project. The 1972 amendments to the Federal Water Pollution control Act (PL92-500) established a comprehensive national water quality program aimed at significantly improving the nation's water resources.

PL92-500 required secondary treatment by 1977 for all municipal wastewater facilities and best practicable waste treatment technology by 1983. The Act also authorized a financial assistance program to pay 75 percent of wastewater treatment construction costs for eligible facilities. The Clean Water Act of 1977 reaffirmed the nation's commitment to the program and authorized $24 billion for the period 1978-82. Over the past decade PL92-500 has financed about $500 million in treatment plant construction in Tennessee. The impact of this program on sewerage capital outlays in the State can be seen in Table II-4 on page 19.

In 1981, Congress appeared to back away from the ambitious goals set in 1972. In that year, it authorized just $2.4 billion for sewage plant construction, a 47 percent reduction in the $4.5 billion level of previous years. Also, Congress amended the law to provide that after October 1, 1984, the federal share of construction costs will drop from 75 percent to 55 percent.

Tennessee has been unable to meet all of its needs for wastewater plant construction, even when the federal allocation was running about $75 million a year. At the present level of funding of $35 million a year, it will take an estimated 36 years to finance total needs as defined by the EPA Needs Assessment and ten years to fund those treatment plants that are currently violating effluent standards. Failing the development of new ways to finance needed sewerage facilities, water quality in Tennessee will continue to deteriorate, and more and more cities will be placed under sewer connection moratoria by State pollution control enforcement actions, thus limiting economic growth in those cities.

Sewerage Investment Needs

The fraction of the total federal appropriation which is alloted to Tennessee for sewage treatment facilities is dependent on the ratio of the needs of Tennessee utilities to the total needs of the nation's utilities. Needs surveys are conducted jointly by the states and the Enviornmental Protection Agency (EPA) according to rigid rules intended to ensure that needs are uniformly calculated for each state, and that no state is able to increase its share of total funding by inflating its needs.

These estimated needs are broken down into several categories: sewage treatment plants; infiltration correction and sewer rehabilitation; interceptor sewers; collector sewers; combined sewers; and storm water sewers. The last three categories are in the lowest need priority and no projects in these categories have been funded in Tennessee. The 1981 amendments to PL92-500 entirely eliminated their eligibility for funding after October, 1984.

Excluding combined and storm water sewers, Tennessee's total needs as defined by the Survey have increased from $1.245 billion in 1976 to $1.488 billion in 1980. Updating the survey to 1982 and adding back combined sewers, Tennessee's needs in 1980 dollars are as follows:

Table II-1

1982 Capital Needs for Sewerage
(1982 dollars in millions)

Need Category	Amount of Need	Percentage Local
Treatment Plants	$ 559.1	45%
Infiltration Correction and Sewer Rehabilitation	155.4	45%
Interceptor Sewers	525.5	45%
New Collector Sewers	473.3	100%
Combined Sewers	259.8	100%
	$1,973.1	

There are currently 94 sewerage investment projects appearing on the Tennessee Division of Water Quality Control's (TDWQC) priority list with a total cost of $224.5 million. These projects are included in the totals shown above. Under the current federal program, local governments will be exclusively responsible for the last two categories of need appearing in the table and will share 45 percent of the costs of the first three categories. Hence local government's costs are $1.291 billion or about 65 percent of the total identified need of $1.973 billion.

The magnitude of these costs raises questions about the ability of local governments to pay their share. Furthermore, the effects of high interest rates, recession, and the recent turmoil in the municipal bond market make it even more difficult to ascertain the financial burden this will place on local governments in Tennessee.

Impact of Capital Needs on Local Finances

In 1979 the Municipal Finance Officer's Association (MFOA) undertook a detailed study of the impact of capital needs for sewerage on the local finances of Tennessee's municipalities.[6] Completed prior to passage of the 1981 Clean Water Act Amendments, the study assumed that federal grants would continue on a 75 percent cost sharing basis and at a level of $75 million a year to the State of Tennessee. Neither of these assumptions turned out to be valid, but the results of the study still point out the severe problems some communities will have in complying with the EPA regulations in PL92-500.

There are approximately 330 units of local government which are potentially affected by the requirements of PL92-500 and nearly 300 currently have projects identified in the EPA Need Assessment. Nearly two thirds of these 300 have populations of less than 3,000 and 40 percent have populations of less than 1,000.

Table II-2 shows the distribution of capital needs in 1978 by city size class. Almost half of total needs results from large projects in a few of the bigger municipalities. The greatest need in the larger cities is for secondary treatment while local collectors and advanced treatment are needed in the smaller cities. Costs of collection vary directly according to the size of the community. Municipalities of less than 1,500 persons show the highest average cost at $600 per capita; municipalities from 1,500 to 5,000 an average cost of $300 per capita; and municipalities greater than 4,000 costs of $100 per capita.

Because many small towns in Tennessee exhibit a need for new collector systems which are no longer eligible for EPA construction grants and because per capita costs are so high in those cities, it is not surprising that many of them will be severely burdened by trying to meet their needs. The annual cost of a new sewer system to a residential customer in Tracy City, Tennessee, with a population of 1,765, is estimated at $441 or 3.5 percent of median household income. By contrast, financing all needed sewerage improvements in Memphis is estimated to increase average annual residential bills by 22 percent to $68.59.[7] This represents just 0.4 percent of median household income in Memphis. The MFOA report concludes that many small unsewered communities will be very heavily burdened if they must finance a complete sewer system. Other small cities already with sewers should be able to afford moderate expansion and upgrading of their systems. Moderate-sized cities heavily in debt will likewise experience excessive burdens not only because of extensive sewer needs but also because of weaker credit capacity. The largest cities in the State should be able to accommodate additional improvements if federal grants remain at

Table II-2

Statewide Costs to Comply with Clean Water Act

By Size of Municipality[1]
(1,000 of 1979 dollars)

Population	Number of Municipalities	Secondary Treatment	Advanced Treatment	Infiltration/ Inflow	Local Collectors	Interceptors	Total	Percent of Total
<1,000	115	$ 10,140	$ 43,150	$ 3,450	$ 76,590	$ 59,101	$ 192,340	11.3
1,000- 3,000	87	7,320	50,080	9,850	58,030	15,200	140,450	8.3
3,000- 5,000	27	5,940	26,140	8,180	22,060	20,270	82,590	4.9
5,000-10,000	34	10,550	63,420	12,110	42,530	23,520	152,130	8.9
10,000-15,000	12	210	47,410	10,300	24,480	27,030	109,430	6.4
15,000-40,000	17	6,700	55,140	20,080	78,130	53,400	213,450	12.6
>40,000	7	144,950	133,090	70,330	258,670	202,960	810,000	47.6
	299	$185,810	$418,430	$134,300	$560,490	$401,390	$1,700,390	100.0

[1] Based on 1978 EPA Needs Survey.

75 percent of total costs, but may experience some difficulty if they have to finance a larger share.

The ability of Tennessee municipalities to bear the costs of needed sewerage projects varies greatly according to population, wealth, present debt levels, and tax structure. As can be seen in Table II-3, 87 percent of Tennessee cities did not have a bond rating in 1980. This considerably limits their abiiity to enter the municipal bond market and consequently to finance their share of sewage investments. From 1969 to 1978 the State of Tennessee provided financial assistance to local governments for the construction of sewage treatment, solid waste, and water supply facilities, in the form of a loan program funded by state general obligation bonds. This program provided many small cities and towns access to credit at reasonable terms. However, this program was terminated in 1978 and replaced by the Local Development Authority (LDA) program. The LDA is authorized to issue revenue bonds for the same purposes but at somewhat higher interest rates because the LDA bonds are not backed by the full faith and credit of the State. Rather, the bonds are backed by a lien on a municipality's State-shared taxes. Since many small cities receive little or no State-shared taxes, their participation in the LDA program is very limited. Hence, at the present time, many units of local government and especially small cities have extreme difficulty coming up with the required local match for needed sewage treatment facilities. Increasing the matching requirements to 45 percent next year will only exacerbate the current problem.

Sewerage Revenues vs. Capital Expenditures

Given the magnitude of capital needs and the current constraints on local governments' borrowing abilities, it is unlikely that sewerage rates can be increased enough to cover all of the costs of required sewerage improvements. On a per capita basis, sewerage capital expenditures are likely to remain close to their recent historical levels in Tennessee which are shown in Table II-4. According to officials at TDWQC, federal grant availability is expected to remain at the present level of $35 million a year for the foreseeable future. One might then expect approximately $630 million from federal sources over the next 18 years. Looking at Table II-5, local capital expenditures for sewage has totaled $693 million since 1972. Approximately $500 million of this figure, or 72 percent, were federal grant funds. Substracting federal grants from the total leaves an annual per capita local effort of about $4.93 per capita for local sewerage capital outlay over the period. Tennessee population is forecast to grow from a 1980 figure of 4.591 million to 5.433 million in the year 2000.[8] Assuming a local effort of about $5.00 per capita between now and 2000, local government is projected to contribute $434.7 million toward sewerage capital expenditures over the period. This leaves a shortfall of approximately $908.4 million as shown on Table II-6.

Table II-3

Bond Rating Distribution
by Size of Municipality[1]

Population	Number of Municipalities	Aaa	Aa	A	Baa	Not Rated
<1,500	154	-	-	-	-	154
1,500- 3,000	48	-	-	-	3	45
3,000- 5,000	27	-	-	-	4	23
5,000-10,000	34	-	-	2	6	26
10,000-15,000	12	-	-	1	4	7
15,000-40,000	17	-	-	10	1	6
>40,000	7	-	3	3	1	-
	299		3	16	19	261

[1] Moody's Bond Ratings

Table II-4

Tennessee Expenditures for Sewerage: 1962-1981
(current dollars in millions)

Fiscal Year	Total Expenditures	Capital Outlay	Other
1962	$ 12.5	$ 9.2	$ 3.3
1967	37.6	32.5	5.1
1971	56.1	46.5	9.6
1972	44.6	33.2	11.4
1973	52.2	36.0	16.2
1974	79.0	61.9	17.1
1975	116.0	96.9	19.1
1976	106.8	81.2	25.6
1977	120.1	87.1	33.0
1978	115.8	78.1	37.7
1979	95.4	50.2	45.2
1980	114.8	61.2	53.6
1981	$198.7	$140.4	$58.3

Source: Data for 1962 and 1967, U.S. Bureau of Census, Census of Governments; data for 1971-1981, U.S. Bureau of Census, Governmental Finances in (Year).

Table II-5

Tennessee Per Capita Expenditures for Sewerage
Compared to U.S. Per Capita Expenditures: 1962-1981

Fiscal Year	Total Expenditures		Capital Outlay		Other	
	Tennessee	U.S.	Tennessee	U.S.	Tennessee	U.S.
1962	$ 3.42	$ 6.83	$ 2.52	$ 4.78	$ .90	$ 2.06
1967	9.66	8.25	8.35	5.41	1.31	2.83
1971	14.06	12.83	11.65	8.46	2.41	4.38
1972	11.06	15.18	8.24	10.04	2.83	5.14
1973	12.65	17.18	8.72	11.57	3.93	5.61
1974	19.13	19.30	14.99	12.50	4.14	6.80
1975	27.70	24.70	23.14	16.75	4.56	7.94
1976	25.34	27.65	19.27	18.41	6.07	9.24
1977	27.94	30.22	20.26	19.45	7.68	10.77
1978	26.58	32.74	17.93	20.02	8.65	12.72
1979	21.78	39.97	11.46	25.53	10.32	14.44
1980	25.00	43.68	13.33	24.69	11.67	15.99
1981	$43.28	$49.10	$30.58	$30.56	$12.70	$18.59

Source: Data for 1962 and 1967, U.S. Bureau of Census, Census of Governments; data for 1971-1981, U.S. Bureau of Census, Governmental Finances in (Year).

Table II-6

Sewerage Capital Outlay - Needs vs. Revenues
(in millions of 1980 dollars)

Capital Outlay Needs	Revenues		Shortfall
	Federal	Local	
$1,973.1	$630.0	$434.7	$908.4

Hence, it is estimated that approximately 37 percent of identified sewerage capital outlay needs will go unmet in Tennessee without massive increases in local sewerage rates and local bonded indebtedness. If the State covers the shortfall by making grants available to local governments, State expenditures would have to increase approximately $50 million a year - a large figure considering Tennessee's relatively inelastic tax structure and the recent slow growth of the State's tax base.

Unidentified Capital Outlay Needs

Little or no data are available on the cost of correcting some of the most serious water quality problems in Tennessee. Soil erosion is one of the primary environmental problems in the State and is a major cause of economic losses associated with agricultural products. There are 317,000 acres of critically eroding areas, including roadways, gullies and abandoned mines, in Tennessee producing an average of 74 tons per acre per year of sediment annually. About 58 percent of soil loss occurs in 21 West Tennessee counties. According to a recent study, "Tennessee has the dubious distinction of having one of the three most severely eroding areas in the nation, as reflected in numerous U.S. Department of Agriculture (USDA) reports."[9] Historically grants and loans to farmers have been made by various agencies of USDA, but the magnitude of the problem has swamped these limited resources. State grants have recently been available through the Obion-Forked Deer River Basin Authority to treat the most critical problem areas, but the demand for funds far exceeds the ability of the Authority to meet them.

It is not clear how much of the cost of reducing soil erosion should be borne by private land-owners or whether the State should expand its role. However, 6,480 miles of stream are 80 percent filled with sediment and this is causing flood damage estimated to run at $40 million annually.[10] It appears that more public funds should be devoted to solving this problem and this decision could be justified purely on a cost-benefit basis.

Other areas for which there is little data are acid mine drainage from orphan strip mines; storm water runoff in urban areas; and pesticide and fertilizer runoff from agricultural lands. Each significantly contributes to water quality degradation in Tennessee but there are no cost estimates

currently available to measure these needs. Hence, overall need in the area of sewerage treatment and water quality management probably far exceeds the $1.973 billion figure.

CHAPTER III. HIGHWAYS

Background

The majority of travel and use of transportation facilities in Tennessee is overwhelmingly oriented to the State's highways, streets and roads. In 1983, there were 81,000 miles of roads in the State of which 50,744 were paved. The Tennessee highway system also includes 16,867 bridges. The Tennessee Department of Transportation (TDOT) has completed a functional classification plan for all roads and streets in the system and grouped the routes into three basic classifications: arterial, collector, and local.

All arterial routes, which include interstate and federal aid primary highways, are under State jurisdiction for upgrading and maintenance. This system consists of approximately 7,300 miles and presently serves more than 60 percent of all travel statewide. There are 18,000 miles under the collector classification. Approximately 5,900 miles are classified as principal collectors and are under State jurisdiction while the remainder are maintained by local government. The principal collector system carries approximately 22 percent of total statewide travel. Improvements to all collector routes maintained by local government are funded from a new local-state-aid program which provides 75 percent State funds and requires a local match of 25 percent.

The remaining local roads and streets which provide direct access to adjacent land are the total responsibility of local governments and are funded by their share of the State tax on gasoline and motor fuels. There are approximately 59,000 miles of local roads which presently serve 15 percent of total travel in the State.

The major priorities of Tennessee's highway program have shifted from building new roads to the maintenance and improvement of existing routes. A closely related priority is constructing and rehabilitating unsafe bridges on both the State and local road systems. According to the U.S. Department of Transportation, 54 percent of all bridges in Tennessee are classified as needing reconstruction. This is a relatively high proportion compared to Tennessee's neighboring states. In the Southeast, Tennessee has a higher proportion of bridges in the deficient category than all other states except North Carolina and Mississippi (see Table III-1).

Among all 50 states, Tennessee has the third highest number of paved road miles rated in the "poor" category under the standards of the American State Highway Transportation Officials (ASHTO).[11] More than 29 percent, or 14,817 miles, of paved road are in poor condition which means they are badly cracked, rutted, or broken in most places. Most pavement

Table III-1

Deficient Bridges in the Southeast

State	Total Bridges in State	Bridges Requiring Reconstruction	Percent Requiring Reconstruction
North Carolina	15,398	11,373	74%
Mississippi	16,468	10,973	67%
Tennessee	16,867	9,025	54%
Alabama	14,802	6,614	45%
Kentucky	12,533	5,339	43%
South Carolina	8,566	1,951	23%
Georgia	14,391	2,533	18%
Virginia	12,237	2,247	18%
Florida	9,011	51	1%

Source: Constructor Magazine, June, 1983.

rated "poor" must be reconstructed. Looking only at the Southeast, Tennessee ranks third behind North Carolina and Kentucky in the percentage of paved road miles that are considered deficient by ASHTO standards (see Table III-2). From these data it appears that Tennessee's highway system is in need of substantial reconstruction and that the State is in worse shape both absolutely and relatively when compared to other states in the Southeast and the nation.

Financing Highway Investments

In Tennessee highways mainly are financed by a gallonage tax on gasoline and motor fuels and by federal transfers from the Highway Trust Fund. And Tennessee, like most other states, has experienced a drastic erosion in gasoline tax revenues over the past decade. Table III-3 shows the growth of these revenues in constant and current dollars since 1964. Between 1964 and 1973 gas tax revenues grew in real terms at a 7.8 percent compound annual rate. By contrast, after the oil embargo of 1973, tax revenues have grown just 1.5 percent a year in current dollars and have declined at an 8.5 percent compound rate in real terms each year. Even though the State enacted a 29 percent increase in the gas tax rate in 1981, collections remained 36 percent below the 1973 figure in real terms in 1982. To maintain momentum in their highway building and maintenance programs, Tennessee State and local governments have had to shift revenues from general taxes (i.e., property and general sales) into their highway department's programs and have had to borrow heavily. Even then, as Table III-4 shows, per capita spending for the maintenance of Tennessee roads and streets has fallen considerably below the national average since 1979.

Future Highway Needs

The cost to meet ASHTO standards by the year 2000 on all miles of the State's existing road network is shown on Table III-5. It comes to nearly $31.2 billion in 1982 dollars. Approximately $24.3 billion is required to improve and rehabilitate existing interstate, federal aid primary and secondary roads, and the State highway system.[12] This figure includes $1.3 billion to complete the interstate system in Tennessee, and $1.8 billion to upgrade the interstate system under the Interstate Repair, Resurfacing, Restoration and Reconstruction Act (4R Act). It also includes $1.367 billion to rebuild bridges on the federal aid primary system.

Because of its huge cost, achieving the goal of reaching ASHTO standards on all 81,000 miles of Tennessee's highway system probably will not be achieved by the year 2000. Perhaps a more realistic goal is to meet what state highway officials define as a "tolerable" system. A "tolerable" system deviates from ASHTO standards in two main ways. Arterial highways would be improved only to the extent that they are functionally adequate to accommodate an average speed of 55 miles per hour throughout the state and collectors would be improved only to current rural roads standards.[13] The cost to upgrade to a "tolerable" system is

Table III-2

Deficient Miles of Pavement in the Southeast

State	Total Paved Miles	"Poor" Rated Mileage	"Fair" Rated Mileage	Total Deficient Miles	Percent Deficient
North Carolina	67,060	20,923	37,352	58,275	86.9%
Kentucky	43,706	8,129	28,409	36,538	83.6%
Tennessee	50,744	14,817	23,088	37,905	74.7%
Virginia	48,623	5,154	29,466	34,620	71.2%
Alabama	57,524	5,120	32,961	38,081	66.2%
South Carolina	44,455	9,336	15,559	24,895	56.0%
Florida	65,033	9,495	26,143	35,638	54.8%
Georgia	61,689	925	27,575	28,500	46.2%
Mississippi	36,973	N.A.	N.A.	13,163	35.1%

Source: Constructor Magazine, June, 1983.

Table III-3

Growth of Tennessee
Gasoline and Motor Fuel Tax Revenue
in Current and Constant Dollars: 1964-1982
(in millions of dollars)

Fiscal Year	Gasoline Tax Revenues in Current Dollars		Gasoline Tax Revenues in Constant Dollars*	
	Amount	Year-to-Year Percent Change	Amount	Year-to-Year Percent Change
1964	$ 99.0	-	$155.2	-
1965	102.9	3.9	156.4	0.8
1966	112.5	9.3	162.1	3.6
1967	118.7	5.5	165.6	2.1
1968	132.9	12.0	177.7	7.3
1969	145.1	9.2	182.3	2.6
1970	153.2	5.6	173.9	-4.6
1971	164.7	7.5	172.2	-1.0
1972	179.6	9.1	179.6	4.3
1973	195.1	8.6	182.7	1.7
1974	204.1	4.6	147.4	-19.3
1975	203.0	-0.5	136.6	-7.3
1976	214.7	5.8	146.8	7.5
1977	227.0	5.7	149.9	2.1
1978	236.2	4.1	130.2	-13.1
1979	246.7	4.5	112.7	-13.4
1980	226.8	-0.8	90.3	-19.9
1981	220.4	-0.3	89.8	-0.6
1982**	$280.1	27.1	$116.7	30.0

* Gasoline tax revenues in current dollars divided by the GNP deflator for fixed investment in structures: government outlays for new highways and streets (1972 = 100).

** In 1981, gasoline taxes were increased from 7 cents to 9 cents a gallon.

Source: Center for High Technology Management and Eocnomic Research at the School of Administrative Science, University of Alabama in Huntsville, Alabama.

Table III-4

Tennessee Per Capita State and Local Expenditures
for Highways Compared to U.S.
Per Capita Expenditures: 1962-1981
(in current dollars)

Fiscal Year	Tennessee		U.S.	
	Capital Outlay	Maintenance Expenditure	Capital Outlay	Maintenance Expenditure
1962	$42.58	$16.18	$37.55	$18.17
1967	51.59	21.15	47.74	22.68
1971	52.28	29.52	57.64	30.09
1972	50.31	33.21	59.15	32.13
1973	49.35	33.69	54.61	34.10
1974	57.57	38.68	57.49	36.86
1975	68.31	43.08	64.04	41.66
1976	78.17	49.91	66.19	45.19
1977	63.57	50.50	57.76	49.04
1978	63.97	54.79	59.15	53.70
1979	77.26	58.42	70.72	58.48
1980	89.33	56.82	84.48	62.59
1981	$85.69	$60.81	$85.34	$67.40

Source: Data for 1962 and 1967, U.S. Bureau of Census, Census of Governments: data for 1971-1981, U.S. Bureau of Census, Governmental Finances in (Year).

TABLE III-5

Total Twenty Year Road and Street Needs in Tennessee
(in millions of 1982 dollars)

Road System*	Total System Miles	Capital Improvements	Maintenance	Operation and Administration**	Percent Distribution of Need	Total
INTERSTATE	1,024	$ 2,923.2***	$ 332.5	$ 162.8	(11%)	$ 3,418.5
STATE HIGHWAYS	9,007	11,077.4	1,260.3	616.9	(42%)	12,954.6
OTHER STATE AID ROADS AND STREETS						
County FAS	7,262	3,759.2	389.8	207.5	(14%)	4,356.5
State Rural Roads	7,253	1,154.4	389.5	77.2	(5%)	1,621.1
City FAU	1,823	1,676.7	200.0	93.8	(6%)	1,970.5
OTHER COUNTY ROADS	45,554	1,911.5	2,446.3	217.9	(15%)	4,575.7
OTHER CITY STREETS	9,271	1,145.6	1,016.6	108.1	(7%)	2,270.3
Total	81,194	$23,648.0	$6,035.0	$1,484.2	(100%)	$31,167.2

* The definition of each road system can be found in Footnote 12.

** Operation and Administration is calculated at approximately 5 percent of the proposed program and includes most of headquarters personnel, statewide garage operations, equipment purchases, supplies, etc.

*** This information was taken from the 1979, 104(b)(5) and the 1980 3R Estimates.

Source: Tennessee Department of Transportation and Center for High Technology Management and Economic Research at the School of Administrative Science, University of Alabama in Huntsville, Alabama.

approximately 80 percent of the cost of meeting full ASHTO standards everywhere.

Highway Revenues vs. Needs

Currently, State and local expenditures for streets and roads are running at $637.1 million a year in Tennessee. State gasoline and motor fuels taxes support about 44 percent of these outlays and federal transfers flowing through the State support another 35 percent. The remaining 21 percent is made up of funds from general taxes, other local highway user fees, such as wheel taxes, and borrowing.

Under the Surface Transportation Assistance Act of 1982, Congress authorized an increase in outlays for the 1983-1986 period nearly 50 percent higher than federal spending for highways in 1982. Most of these increases will be used to repair and rehabilitate the interstate and federal aid primary highway systems and complete the remaining part of the interstate system. This should free up state and local funds for use on other parts of the highway system and reduce, to some extent, their share of total highway expenditures.

Table III-6 provides estimates on how much would have to be spent each year by Tennessee State and local governments to meet various levels of adequacy as defined by ASHTO standards. To fully meet ASHTO standards, annual expenditures would have to average nearly $1.7 billion in constant dollars over the 18-year period. Because expenditures likely would grow incrementally, total outlays in the terminal year probably would be over $2.0 billion in constant dollars. Depending on one's assumptions about future inflation levels, current dollar highway outlays would have to grow 10 to 12 percent each year (6.5 percent in real dollars) and state gasoline tax rates would have to be increased 25 or 35 cents a gallon from 9 cents by the year 2000.[14] This level of taxing and spending is not likely to be sustainable for a full 18-year period so a more realistic measure of needs is what it would take to build a "tolerable" system by the year 2000.

The total cost of constructing a "tolerable" system is estimated at $24,933.8 million in 1982 dollars, as shown in column two of Table III-6. This is 80 percent of the outlays needed to rebuild the whole system to ASHTO standards. In this case, annual expenditures would have to average approximately $1.4 billion a year. Depending on whether the State gasoline tax pays for 40 or 50 percent of this need, tax rates would have to increase to 16 to 26 cents a gallon or 20 to 30 cents a gallon respectively.[12] To achieve this level of spending, the Tennessee gasoline tax would have to be incrementally increased by more than two cents each year for the rest of this decade. Such a rapid escalation of the tax rate is unlikely to be acceptable politically.

Because of the substantial increases in State gasoline taxes needed to meet even 80 percent of the ASHTO standard by the year 2000, it is likely that Tennessee State and local governments only will be able to meet approximately 65 percent of the standard by that year. This would entail

TABLE III-6

State and Local Expenditures Required
to Meet Various Highway Improvement Levels: 1982-2000
(in millions of 1982 dollars)

	To Meet ASHTO Standards	To Meet 80% of Standards	To Meet 65% of Standards	To Meet 50% of Standards
Amount needed over 18-year period	$31,167.2	$24,933.8	$20,258.7	$15,583.6
Annual average outlay over 18-year period (per year)	$ 1,731.5	$ 1,385.2	$ 1,125.5	$ 865.7
Annual average gasoline tax revenue to support 50% of need (per year)	$ 865.8	$ 692.6	$ 562.7	$ 432.9
Gallonage tax to support 50% of need (per gallon)	25-35¢	20-30¢	16-26¢	13-23¢
Annual average gasoline tax revenue to support 40% of need (per year)	$ 692.6	$ 554.1	$ 450.2	$ 346.3
Gallonage tax to support 40% of need (per gallon)	20-30¢	16-26¢	13-23¢	09-19¢

Source: Center for High Technology Management and Economic Research at the School of Administrative Science, University of Alabama in Huntsville, Alabama.

average annual expenditures of $1,125.5 million in 1982 dollars over the next 18 years and an increase in the State gas tax from 13 to 23 cents if the tax is required to pick up 40 percent of needs or 16 to 26 cents if it picks up 50 percent. Note that reaching 65 percent of ASHTO standards will probably still require a massive increase in State gasoline tax rates -- up nearly 300 percent over the current rate if the State tax must pay one-half the cost and if gasoline consumption continues to decline in the future.

Hence, the difference between what it would take to reach 80 percent of the standard (a "tolerable" system) and what the State is likely to reach with a significantly expanded highway program (65 percent of the standard) is the low measure of unmet needs for highways. The high measure of need is the difference between the cost of the "tolerable" system and outlays if the State only moderately expands highway reconstruction for the next 18 years. With a moderately expanded program, the Tennessee highway system should meet about 50 percent of ASHTO standards in the year 2000 (see Table III-7).

Table III-7

Needs vs. Revenues
for Meeting 80% of ASHTO Standards
on Tennessee's Existing Highway System
(in millions of 1982 dollars)

Cost of meeting 80% of the standards	=	$24,933.8
Revenues to meet 65% of the standards	=	$20,258.7
Revenues to meet 50% of the standards	=	$15,583.6
Low estimate of the shortfall	=	$ 4,675.1
High estimate of the shortfall	=	$ 9,350.2

Tennessee's State and local highway system is the single most costly infrastructure need at present. The cost of rebuilding and rehabilitating bridges by itself is estimated at $5.7 billion in 1982 dollars.[15] Any significant upgrading or rehabilitation of the highway system will require substantial increases in the State gasoline and motor fuels tax. Present spending levels will allow Tennessee State and local governments to meet less than half of measured needs by the year 2000.

CHAPTER IV. AIRPORTS

The Aeronautics Division of the Tennessee Department of Transportation has prepared a 20-year estimate of needed capital improvements at the State's 74 publicly-owned and 78 privately-owned airports. The 1980 Tennessee Airport System Plan (TASP) reduces the number of new airports called for in earlier plans while stating that, "Better utilization and improvement of existing facilities has become a primary goal in the overall [airport] system...."[16] While calling for the creation of new general aviation facilities in 10 locations across the State, most of the needed capital investments will be for the upgrading, expansion and rehabilitation of existing facilities at the State's 74 publicly-owned airports.

Funds to pay for airport improvements come primarily from the Federal Aviation Administration's (FAA) Airport and Airways Trust Fund and from landing fees and other revenues raised by local airport authorities. The Airport and Airways Trust Fund is supported mainly by an 8 percent tax on domestic passenger tickets and a 14-cents-per-gallon tax on aviation jet fuel (12 cents on gasoline). Collections from user fees are distributed to major airports in the form of matching grants determined by a formula based on passenger volume. Collections are distributed to smaller airports in the form of block grants to states. In 1982, the FAA was spending a yearly total of $410 million dollars for airport capital improvements. Over the next five years, the FAA plans to double annual capital expenditures bringing outlays to $900 million in 1987.[17]

Costs are projected in the Tennessee Airport System Plan for a 20-year period but revenues for only five years. The projections cover both general and air carrier airports and are shown in Table IV-1. Total costs of upgrading Tennessee's existing airports is $379.2 million for the 20-year period in 1982 dollars. Total needs for 1980-1985 are $152.6 million and revenues to cover these needs are projected to be only $49.5 million leaving a shortfall of $103.0 million.

The rapid increase in federal outlays from the Airport and Airways Trust Fund can be expected to reduce the magnitude of this shortfall considerably. If federal funds pick up one-half of the total estimated needs of $379.2 million for the 20-year planning period and there is no increase in locally generated revenue, the total shortfall for 20 years would be approximately $73.6 million. However, if airport operations increase as forecast and landing fees are appropriately increased as well, the shortfall could be entirely eliminated. These estimates do not include funds for the ten new airports that have been identified as needed during the 20-year period. However, it is not known how many of these airports will actually get built. Under existing criteria only two appear to be

needed immediately -- one in Nashville and one in Oak Ridge -- and their completion is dependent on resolving numerous community conflicts.

Table IV-1

Cost and Projected Revenues for the
Existing Tennessee Airport System: 1980-2000
(1982 dollars in millions)

	Needs	Revenues		Shortfall
		Federal	Local	
Total	$379.2	$189.6	$116.0	$73.6

CHAPTER V. WATER SYSTEMS

Background

According to the Tennessee Division of Water Quality Control (TDWQC) there are 607 community water systems in Tennessee. Groundwater supplied 315, surface water supplied 132, and the remaining 160 systems had no water source of their own, but bought water from another system. There has been a tremendous growth of rural water utility districts in Tennessee in the past few decades, and most rural counties now have several. Many are very small and have difficulty providing the maintenance and operation function necessary for good water service. Because many small and medium-sized water utility districts in Tennessee depend on small surface streams or shallow groundwater wells, they are subject to shortages caused by periodic droughts. Many streams in Middle and East Tennessee typically run dry, or at a very low flow during the Summer. These streams are not reliable sources of domestic water supply even though used by many rural utility districts.

The most recent serious drought in Tennessee occurred during the summer of 1980. Several utilities experienced a shortage because dry weather encouraged more lawn and garden irrigation, and the extra demand overtaxed the treatment, pumping, and distribution system even though there was no shortage of water at the source. On the other hand, many utilities experienced a shortage because the source began to run dry. A number of cities without any seasonal storage, especially on the Cumberland Plateau, ran completely out of water and water had to be trucked in by the National Guard in tanker trucks.[18]

TDWQC personnel indicate that about 10 percent of all water systems in the State experienced significant shortages during the 1980 drought. Through a survey, the Tennessee Water Resources Research Center located 28 such systems and they are listed along with the problems they encountered in Appendix B. Most of them are located in the rapidly urbanizing portions of the Memphis, Nashville, and Chattanooga Metropolitan Areas, and in rural Eastern and Middle Tennessee. Of these 28 systems, 12 had water shortages because of limited treatment, pumping or distribution capacity. The other 16 systems had problems because their water source was inadequate: springs went dry, the water level in wells fell too low, or streams ran too low or dried up completely. This recent history suggests that 40 to 50 water systems need substantial upgrading to meet current needs and there are probably dozens more in the State that are now operating close to capacity.

Financing Water Supply

Developing municipal water supply has traditionally been a local responsibility, and the federal and state roles have been small. In Tennessee federal grants and loans have been made available from the Farmers Home Administration (FmHA), Economic Development Administration (EDA), Housing and Urban Development (HUD), and Appalachian Regional Commission (ARC).

FmHA has been the most important program. Federal funds are available to all public entities with populations of 10,000 or less. These funds can be invested in installation, repair, improvement, or expansion of rural water facilities but they cannot be used for normal operation or maintenance of existing systems. In place of loans, the federal government offers direct grants with no local matching requirements, but only to reduce user charges to what federal authorities deem a "reasonable" level, based on the ratio of debt service to median local income. Funds are allocated to states on the basis of rural population and number of households with annual incomes below the federally established poverty level.

Data in Table V-1 shows that capital expenditures for water supply grew dramatically in 1980 and 1981, probably as a result of the drought in those years. On a per capita basis, capital outlay in Tennessee is now running at levels nearly twice as high as the comparable national figure (Table V-2). Debt service is likewise growing quite rapidly.

If one assumes that this rapid increase in capital outlay is a temporary phenomenon due to the effects of the drought and that it will return to more normal levels during the rest of this decade and next, it is probably reasonable to assume that per capita capital outlays will average about what they were in the 1975-1979 period (approximately $12.00 per capita). Given the aforementioned population projections, local capital needs for water supply would be approximately $1,209.9 billion in 1982 dollars for the 18-year period. Another severe drought or more rapid growth in population would increase this figure, and lower than projected population growth would reduce it.

Nearly all of this cost will be borne by local water utilities and consequently local rate payers. Although it is probably true that water rates are low in many Tennessee jurisdictions and can be increased without significantly burdening consumers, in poorer rural counties and in counties experiencing rapid urbanization, required rate increases could become a serious burden and preclude future economic growth. Many of Tennessee's rural counties have experienced significant population growth over the past decade and most of them are now served by a number of small utility districts. Because of their size and the low density of their service areas, they cannot reach significant economies of scale. In some cases these systems can be combined into larger, more viable entities, but this option is not always available. It appears that in some cases subsidies in the form of grants and low interest loans will still be needed in the future.

Table V-1

Tennessee Expenditures for Water Supply: 1962-1981
(current dollars in millions)

Fiscal Year	Total Expenditures	Capital Outlay	Current Operation	Interest on Debt
1962	$ 36.6	$ 17.0	$ 15.5	$ 4.1
1967	55.9	29.2	19.4	7.4
1971	87.5	45.0	28.8	13.7
1972	76.1	29.7	32.6	13.7
1973	85.1	32.6	36.9	15.6
1974	146.9	77.9	45.3	23.8
1975	122.2	45.3	51.5	27.4
1976	123.7	41.4	59.4	22.9
1977	138.7	42.0	71.4	25.3
1978	172.6	55.8	82.2	34.5
1979	191.3	75.3	85.9	30.1
1980	275.1	143.5	98.5	33.1
1981	$281.2	$129.2	$113.9	$38.1

Source: Data for 1962-1967, U.S. Bureau of Census, Census of Governments; data for 1971-1981, U.S. Bureau of Census, Governmental Finances in (Year).

Table V-2

Tennessee Per Capita Capital Expenditures for Water Supply Compared to U.S. Per Capita Capital Expenditures: 1962-1981

Fiscal Year	Per Capita Capital Expenditures Tennessee	U.S.
1962	$ 4.65	$ 4.91
1967	7.50	5.34
1971	11.28	6.03
1972	7.37	6.44
1973	7.90	6.83
1974	18.87	8.25
1975	10.82	9.91
1976	9.82	10.29
1977	9.77	10.63
1978	12.81	9.80
1979	17.19	12.14
1980	31.26	14.43
1981	$28.14	$16.41

Source: Data for 1962-1967, U.S. Bureau of Census, Census of Governments; data for 1971-1981, U.S. Bureau of Census, Governmental Finances in (Year).

CHAPTER VI. MASS TRANSIT

Background

Public transit service is provided by local governments in eight Tennessee cities: Chattanooga, Knoxville, Memphis, Nashville, Bristol, Gatlinburg, Jackson, and Johnson City. The transit systems in these areas offer several different types and levels of service, including scheduled service on designated routes, special services for the elderly and handicapped, shuttle and charter service, and assistance in commuter ridesharing (carpool, vanpool, bus pool) activities.

The highest levels of service are provided in the State's four largest cities while the systems in Bristol, Jackson, and Johnson City focus on providing basic mobility for those citizens who are unable to rely on other forms of transportation. Gatlinburg's transit system is designed to reduce traffic congestion and improve accessibility for tourists

These eight transit systems carried more than 40 million passengers in 1980, an average of almost 160,000 passengers a day. This was accomplished with a fleet of approximately 700 transit vehicles, which operated a total of more than 20 million miles. The Memphis Area Transit Authority (MATA) is the largest public transit system in the State and operates 140 buses on 23 routes within the City of Memphis during peak hours.

Financing Mass Transit

In Tennessee as in the rest of the country, transit ridership has drastically declined since the end of World War II. Although Tennessee's transit systems operate very efficiently in comparison with similar systems in other states, fare-box revenues now cover only 42 percent of operating costs.[19] Through operating grant subsidies, the federal government pays for approximately 28 percent and State and local governments the remaining 30 percent of total costs. Tennessee public transit is now heavily reliant on these federal subsidies; and, with the limitations placed on federal operating assistance under the Surface Transportation Assistance Act of 1982, most have had to substantially reduce services. During 1982 MATA implemented a series of service reductions and fare increases to offset rising operating costs and declining federal subsidies. As a result, service was reduced 45 percent and ridership declined by approximately 30 percent.[20]

Limitations on federal operating subsidies have put the State's transit systems in a vicious circle. Subsidy losses have led to service

cutbacks which have reduced ridership and increased fares which, in turn, have cut ridership even more. One can visualize a situation arising in the future where service cutbacks become so widespread that even the largest public transit system in the State, MATA, is no longer viable. The ability of Tennessee State and local governments to make up for the loss of federal subsidies is very limited. A one-cent local option gasoline tax dedicated to transit purposes in Memphis was approved by the Legislature in 1982 but its implementation is conditioned on a local referendum. Even if it were to pass, a one-cent increase is unlikely to be enough to maintain current levels of service through the end of the decade. As discussed in Chapter III, State gasoline tax rates are likely to grow substantially in future years just to meet the maintenance and upgrading requirements of the State's road system. Imposition of local option gasoline taxes to support mass transit on top of these increases could drive the rate up to prohibitive levels in the State's major cities.

Some effort has been made to estimate the cost of shutting down all of the State's public transit systems. The Tennessee Department of Transportation (TDOT) has listed the following likely impacts if all public transit were shut down in the major cities:[21]

1. Increase by 42,000 the number of vehicles using the streets and roads in the most congested traffic corridors of the major cities. This in turn would increase the probability of accidents and reduce the overall safety of the motoring public.

2. Reduce the ambient air quality in the State's central cities. Diesel buses emit substantially less pollution than private automobiles and one fully loaded bus can replace an average of 32 cars.

3. Increase the use of scarce energy resources and reduce the overall energy efficiency of the State's transportation system.

4 Increase the community's vulnerability to fuel shortages and reduce the ability of local governments to provide transportation during civil emergencies or natural disasters.

5. Increase the amount of unemployment by approximately 6,000. An estimated 10 to 15 percent of current riders would not be able to find alternative means of transportation and would be forced out of the labor market as a result.

Mass Transit Revenues vs. Needs

Capital needs of the four major public transit systems for the period fiscal 1983 to 1987 are estimated at approximately $130 million.[22] More than $77.4 million is required in Memphis alone. However, it is expected that enough federal funds will be made available to meet a higher percentage of this need in the future. Some parts of the Interstate system

will not be finished in Memphis thereby freeing up federal road money for mass transit capital projects through the Interstate Substitution Program. Memphis has allocated $40.5 million out of the highway program to purchase new buses and upgrade park-and-ride facilities. It is not anticipated that funding capital needs will place an undue burden on State and local government. Rather, the difficulty appears to be the loss of federal operating subsidies.

The total operating costs of the eight transportation systems in fiscal 1980 was more than $34 million, and approximately 72 percent of this amount was for labor. Fuel and lubricants was the second most important cost category at 13 percent. Public transit in Tennessee is highly labor intensive, and employees of five of the eight systems are unionized. It is unlikely that operating costs can be reduced appreciably without significant reductions in labor costs, and these reductions will be difficult to achieve.

If operating costs increase 2 percent a year in real terms, it will require $977.4 million in 1982 dollars to operate the State's eight existing bus systems at current service levels for the 18-year period (see Table VI-1). If operating costs increase 4 percent a year, it will cost $1,221.5 million in 1982 dollars. Fare-box revenue probably cannot be increased appreciably in real terms from current levels, so in Table VI-1 it is assumed that local revenue primarily from fares does not increase over the 18-year period. Likewise, federal operating subsidies are held constant in real terms. Given these assumptions, the shortfall in local transit systems' operating budgets will be on the order of $224 to $468 million over the next 18 years. Shortfalls of this magnitude probably mean that local governments will have to raise taxes to subsidize their mass transit systems or drastically curtail services. Without substantial cuts in labor costs or future increases in federal subsidies, it appears certain that public transit services will be drastically cut or entirely eliminated in most of Tennessee's major cities sometime during the next 18 years. This will make Tennessee cities extremely vulnerable to any future energy crisis and could do irreparable long term damage to the State's urban economy.

Table VI-1

Mass Transit Needs vs. Revenues
to Meet Operating Expenditures
on Existing Systems: 1983-2000
(in millions of 1982 dollars)

	Total Operating Costs: 1983-2000	Local Revenue	Federal Operating Subsidy	Shortfall
Operating costs increase at 2% a year in real terms	$ 977.4	$335.9	$417.6	$223.9
Operating costs increase at 4% a year in real terms	$1,221.5	$335.9	$417.6	$468.0

Source: Center for High Technology Management and Economic Research at the School of Administrative Science, University of Alabama in Huntsville, Alabama.

FOOTNOTES

1. Center for Business and Economic Research, University of Tennessee, An Economic Report to the Governor of The State of Tennessee, January, 1983, p. 62.

2. Data for capital outlays come from various State Budget Documents published by the Tennessee Department of Finance and Administration.

3. Memo from Ben Smith, Director of the Safe Growth Team, to the Task Force on Water Project Financing, dated August 3, 1983.

4. Handout from the Tennessee Department of Transportation entitled, A Study for Possible Realignment of Maintenance and Jurisdictional Responsibility Based on Highway Functional Classification Criteria.

5. Tennessee Valley Authority: "Is Water Getting Cleaner?", November, 1980.

6. John E. Peterson and Pat Watt, Fiscal Impact of Construction of Municipal Wastewater Treatment Facilities in Tennessee, Municipal Finance Officer's Association, Washington, D. C., February, 1981.

7. John E. Peterson and Pat Watt, Ibid., Table II-8, page II-21.

8. Jon C. Jacobsen and Donald W. Hastings, Population Projections for Tennessee Counties, 1990-2000, Tennessee State Planning Office, Nashville, TN, May, 1983.

9. Edward L. Thackston, et. al., Water Policy in Tennessee: Issues and Alternatives, Water Resources Research Center, University of Tennessee, Knoxville, TN, April, 1983, page 297.

10. Edward L. Thackston, Ibid., page 298.

11. Constructor Magazine, June, 1983, p. 18.

12. Highways are classified according to the state and federal programs under which they are maintained and improved. All interstates are eligible for 90 percent federal funding and appear as a separate category in Table III-5. The state highway category in the Table includes other main federal routes (i.e., federal aid primary highways) and exclusively state maintained highways (state highways) as well as federally aided secondary roads maintained exclusively by the state. County federal aid secondary (FAS) roads are eligible for federal funding as are city federal aid urban (FAU) streets maintained by the cities. State rural roads are exclusively maintained by the counties and

are eligible for state assistance under the rural roads program. All roads and streets listed under the "other" category in Table III-5 are the exclusive responsibility of counties and cities respectively and are not eligible for either state or federal aid.

13. The "tolerable" system does not provide for a supplemental expressway system beyond the existing designated interstate network for the majority of 1,625 miles of principal arterials. Principal arterials are upgraded to a design speed of 55 miles per hour but not to interstate standards. Highways designated as collectors (approximately 18,000 miles) are not upgraded to current federal aid secondary standards but to standards prevailing on the state aided rural road system.

14. The lower tax figure assumes a constant level of gasoline consumption over the 18-year period while the higher figure assumes continuing declines in consumption as prices and taxes increase and people's spending patterns shift in response.

15. These bridge rehabilitation costs, reported in a letter from Robert Farris, Tennessee Commissioner of Transportation, are broken down as follows: Interstate System, $264.0 million; State System, $3,190.0 million; and Local Streets and Roads, $2,247.0 million.

16. Tennessee Department of Transportation, Volume I, Summary Report, Tennessee Airport System Plan, Nashville, TN, 1981, p. 25.

17. Congressional Budget Office, Public Works Infrastructure: Policy Considerations for the 1980s. Congress of the United States, Washington, D. C., April, 1983, p. 106.

18. Edward L. Thackston, et. al., Water Policy in Tennessee: Issues and Alternatives, Water Resources Research Center, University of Tennessee, Knoxville, TN, April, 1983, p. 87.

19. Tennessee Department of Transportation, Costs and Benefits of Public Transit in Tennessee's Urban Areas, Nashville, TN, February, 1982, p. 4.

20. Office of Planning and Development, Memphis and Shelby County, Transportation Improvement Program: 1983-1987, Memphis, TN, June, 1983, p. 11.

21. Tennessee Department of Transportation, op. cit., pp. 19-21.

22. Transportation Improvement Plans for Chattanooga, Knoxville, Memphis, and Nashville.

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Appendix A

Tennessee Department of Health and Environment
Division of Water Quality Control

Wastewater Moratoriums - January 26, 1983

Facility Name	County	Date Imposed	Type and Status
Brentwood, City of	Williamson	11-13-80	Connections and line extensions prohibited; Did not allow prior commitments; Modified 8-24-82, line extensions allowed, taps allowed not to exceed 70,000 gpd (30,000 industrial and 40,000 residential); Wili be reimposed on 5-1-83 unless connected to Metro Sewer.
Candies Creek Sanitation District	Bradley	5-21-80	Connections and line extension prohibited; legal prior commitments allowed; No modification or relaxation.
Chattanooga, City of (Moccasin Bend STP)	Hamilton	12-22-81	Requires Division approval prior to connection of any industrial discharge greater than 20,000 gpd or 200 city "population equivalents"; No modification or relaxation.
Cookeville, City of	Putnam	9-22-81	Connections and line extension prohibited except legal prior commitments and connections to existing lines of single family residences and small commercial estabilishments (domestic wastewater only); No modification or relaxation.
Covington, City of	Tipton	9-4-81	Additional sewer mains or main extensions prohibited except those allowed under 12-11-80 legal obligation list; residential connections not prohibited; small business domestic connections not prohibited; all other connections require prior approval of WQC; Agreed Order replaced C.O. 80-016.

Appendix A

Facility Name	County	Date Imposed	Type and Status
Crossville, City of	Cumberland	5-27-82	Connections and line extensions prohibited except those lines approved before date of Order; connections legally obligated before 12-7-79 allowed; agreed order replaced C.O. 78-014A and 81-001.
Gallatin, City of	Sumner	11-2-81	Connections and extensions above 210 lbs/day of BOD_5 or flow of 105,000 gpd total additions prohibited except with written approval of WQC; No relaxation or modification.
Greeneville, City of	Greene	1-14-83	Connections and line extensions including prior commitments prohibited; only structures under construction and health hazards allowed.
Hohenwald, City of	Lewis	7-19-82	Line extension moratorium.
Johnson, City of (Knob Creek Plant)	Washington	7-29-82	Line extension moratorium.
LaVergne Utility District	Rutherford	3-3-76	No additional connections; No relaxation or modification.
Lebanon, City of	Wilson	6-13-78	Connections and extension prohibited except prior legal commitments, without written approval of WQC; modified 8-4-82 to allow connections up to a total of 300,000 gpd or 600 lbs/BOD_5; however, no additional connections to be made in northeast quadrant of city.
Manchester, City of	Coffee	3-30-81	Line extension moratorium.
Madisonville, City of	Monroe	12-8-82	Connections and extensions prohibited including prior commitments; only structures under construction and health hazards allowed; No relaxation or modification.

Appendix A

Facility Name	County	Date Imposed	Type and Status
Mountain City	Johnson	9-28-76	Connections and extensions prohibited; allows "trade-offs".
Niota, City of	McMinn	2-18-76	Industrial connections prohibited without written approval of WQC; No relaxation or modification.
Springfield, City of	Robertson	2-14-78	Connections and modifications to existing connections prohibited except prior legal commitments; no relaxation or modification.
Tullahoma, City of	Coffee	12-5-77	Connections and extensions prohibited except prior legal commitments; relaxed 9-14-81 to allow additional 100,000 gpd flow.
Monteagle, City of	Grundy	7-2-82	Line extension moratorium.
Cherokee-Hartshaw Utility District	Green	12-20-82	Line extension moratorium.
Jonesboro, City of	Washington	3-1-82	Connections and extensions prohibited; prior commitments approved by the Division; allowed "trade-off"; no relaxation or modification.
Knoxville, City of (Fourth Creek STP)	Knox	4-8-83	Line extension moratorium. Also affects First Utility District and West Knox U. D. (contributing lines).
Daisy-Soddy-Falling Utility District	Hamilton	3-19-80	Total number of connections frozen at number present on the date of the order without written approval of WQC; allowed connections if total number did not exceed this number; Did not mention prior legal commitments; no modification or relaxation.

Appendix A

Facility Name	County	Date Imposed	Type and Status
Shady-Grove Utility District	Jefferson	5-19-80	Connections and line extensions prohibited except prior legal commitments; no modification or relaxation.
Tracy City Water System	Grundy	3-11-81	Connections and line extensions prohibited except prior legal commitments; No modification or relaxation.

LCB/dgwCGL/H2

Appendix B

Tennessee Water Supply Problems

Time	System	Problem
	NASHVILLE BASIN	
1980	Murfreesboro	raw water supply
1980	Franklin	raw water supply and high turbidity in spring supply
1980	Consolidated U.D. (Rutherford County)	Related to Murfreesboro
1980	Oneida	Lake source was very low
dry weather	Van Leer (Dickson County)	spring gets muddy during dry weather; looking for a new source
every summer	Whiteouse U.D. (Sumner & Robertson County)	Ridgetop area has low pressure due to small lines
in summer	HB and TS U.D. (Williamson County)	not enough storage
mainly in dry weather	Tracy City	cave spring goes dry; recently developed wells
Summer, 1980	Spencer	lake source insufficient; constructed a raw water intake on nearby creek as supplement
1980	Greenbriar	storage and impoundment
1980	Dickson	raw water supply

Appendix B

Time	System	Problem
1980	McMinnville	treatment plant capacity
1980	Cumberland U.D. (Davidson County)	low pressure areas
1980	Lafayette	raw water source
1980	Mt. Pleasant	raw water source
	JACKSON BASIN	
Summer, 1980	Germantown	insufficient high service pumping capacity, announced on radio to conserve water; added pumps and storage
Summer, 1980	Selmer	guys area out of water due to high demand and lack of booster pumps; added booster station
Summer, 1980	Savannah (rumor)	allowed elevated tank to drop too low so pumped 24 hours to try to keep up with demand
Summer, 1980	Lauderdale County - Wide U.D.	elevated storage emptied due to telemetering problems and standpipe could not feed system
	CHATTANOOGA BASIN	
June, 1980	Dunlap	raw water pump went out causing shortage in some areas and no water in others for about two weeks; installed larger raw water pump and doubled treatment plant

Appendix B

Time	System	Problem
Summer, 1980	Daisy-Soddy-Falling (Hamilton County)	could not meet demand; tied to Hixson U.D., but tanks still low and high elevations were without water; expanded treatment plant, but still low pressure in high areas; now upgrading distribution system and developing a two-pressure system
Summer, 1982 (flood)	Daisy-Soddy-Falling (Hamilton County)	line over Chicamauga Creek washed out with bridge, disconnecting Daisy-Soddy from Falling Water; Falling Water's well could not meet demand and other lines broke so tanks drained
Summer, 1982	Jasper	Whiteside area, 8-inch line washed out and area was without water for several days
July, 1980	Eastside U.D. (Hamilton County)	low or no pressure during high demand; increased high service pump capacity and added clearwell storage
July, 1980 December, 1980	Mowbray Mt. U.D. (Hamilton County)	lake source low almost no distribution water due to high service pump going down and could not get spare parts promptly
November, 1981-June, 1982	Mowbray Mt. U.D.	lake dried up so hauled water; soon tying to Daisy-Soddy-Falling Water U.D.'s new plant
August, 1981	Union Fork-Bakewell U.D. (Hamilton County)	High demand and large leak caused many customers to be out of water for several days; made an emergency connection to Sale Creek U.D.
	KNOXVILLE BASIN	
Previous Droughts	Crossville Water Department	water sources are Holiday Hills Lake and Meadow Park Lake. During droughts, lake levels have nearly dropped below water intakes

Appendix B

Time	System	Problem
shortages nearly every day	Shady Grove U.D.	water is purchased from Jefferson City. Undersized booster pumps and distribution lines cause frequent shortages